RUBY RIVER STREAM INVENTORY REPORT

SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE
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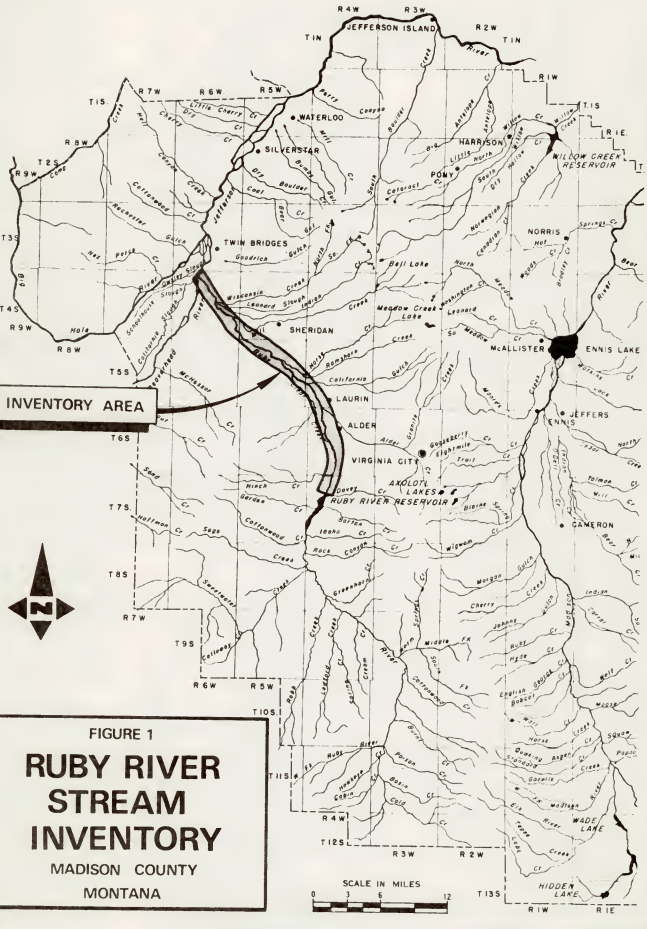
RUBY RIVER STREAM INVENTORY

INTRODUCTION

The Ruby River, a principal tributary of the Beaverhead and Jefferson Rivers of southwestern Montana, has for many years been the focal point of considerable debate regarding stream alterations or modifications. Throughout the debate, emotions--rather than facts--have frequently "muddied the waters" of the Ruby River. Perhaps the area invoking the greatest amount of discussion dealt with stream channel and bank alterations and streambank protection through use of structural measures.

The Soil Conservation Service, having been involved with streambank protection activities on the Ruby River for a number of years, recognized, as did others, that the lack of a quantitative measure of stream alterations and modifications contributed to the emotional climate of the Ruby River debate.

As a step toward implementing a systems management approach to activities involving rivers and streams as well as providing a quantified measure of stream problems, the Soil Conservation Service conducted a stream inventory of the Ruby River from the Ruby Dam to its confluence with the Beaverhead River, a distance of 48.55 river miles, in August 1974. Within the scope of this survey were inventories of bank and streambed alterations that included the location and linear footage of disturbed river gravels, rock riprap, rock jetties, and bank brush removal, as well as eroding banks, critical sediment sources, irrigation headgates, and diversions.


INVENTORY AREA
JEFFERSON ISLAND
WATERLOO
SILVERSTAR
HARRISON
POMY
WILLOW CREEK RESERVOIR
TWIN BRIDGES
Ruby River
Ball Lake
Meadow Creek Lake
NORRIS
SHERIDAN
McALLISTER
ENNIS LAKE
LAURIN
ALDER
VIRGINIA CITY
ENNIS
AXOLOTL LAKES
RUBY RIVER RESERVOIR
CAMERON
WADE LAKE
HIDDEN LAKE
SCALE IN MILES
0 3 6 12
FIGURE 1
RUBY RIVER STREAM INVENTORY
MADISON COUNTY
MONTANA

The Setting

The Ruby River, formed by drainages arising in the Snowcrest, Gravelly, and Green Horn mountain ranges of southern Madison County, flows in a northerly direction to the Beaverhead River in the vicinity of Twin Bridges, Montana. The Ruby River basin drains 596 square miles, much of which lies within the Beaverhead National Forest. The average stream discharge from Ruby Reservoir is 220 cubic feet per second with a total yield of 159,400 acre-feet per year, based on the period 1963-1973.

The Ruby River is the source of water for the Ruby storage reservoir, constructed in 1937. Ruby reservoir, lying about midway in the Ruby River system, is located seven miles upstream from the community of Alder. With a capacity of 38,000 acre-feet, the reservoir was designed to provide a full supply of irrigation water for 14,000 acres of crop and pastureland and supplemental water for an additional 20,000 acres of irrigated land in Ruby valley.

The Ruby River is typical of many intermountain streams within Montana. From Ruby Dam to the Beaverhead River, a distance of about 24 miles, the Ruby River stream course flows for 48.55 miles, for a stream-to-valley ratio of approximately 2:1. Changes in stream elevations within the survey area range from approximately 5,394 feet above sea level at Ruby reservoir to approximately 4,634 feet at the confluence with the Beaverhead River, for a drop in elevation of about 760 feet.

Vegetation along the Ruby River stream course is characterized by a riparian belt consisting of such woody species as cottonwood, willow, redosier dogwood, wild rose, and snowberry.

Under prevailing reservoir management procedures, the Ruby reservoir is generally filled to or near capacity prior to the spring runoff period. As a result, the reservoir provides little or no reduction in peak flows. Sustained, large-volume flows released from the reservoir during spring, early summer, and following the irrigation season have contributed to unstable streambanks, erosion, and aggravates natural sedimentation conditions throughout much of the lower Ruby River. This problem has been especially prevalent during the present wet cycle.

As a result of severe soil erosion problems above the reservoir and the passage of high flows during the spring, suspended sediments are being carried through the reservoir and deposited downstream. These fine sediments are contributing to the degradation of trout spawning gravels throughout much of the lower Ruby River. These and other problems, including cutting of oxbows, channel straightening, removal or reduction of streambank cover, have necessitated installation of streambank protection measures over the years.

Methods and Procedures

The Ruby River stream inventory was conducted during August 1974 by floating the river from Ruby Dam to the Beaverhead River. A three-man survey party

made the trip in a 14-foot aluminum "Jon" river boat. Instream and bank problem areas were recorded on field forms and on large-scale (1:3,000 or 1"=250') aerial photographs of the Ruby River taken in 1973 by the Montana Department of Highways. Before initiating field work, aerial photos were indexed for ease of use and a field inventory form was developed following review by Soil Conservation Service field and state office personnel.

The inventory, conducted systemmatically by stream reach, required three and one-half days field work. Observations recorded on aerial photos during the inventory included the following:

1. Stream channel alteration and realignment
2. Streambank alterations
    a. blanket rock riprap
    b. rock jetties
    c. car bodies as riprap
    d. altered riverbank gravel
    e. brush removal
3. Eroding banks
4. Critical sediment sources
5. Irrigation return flows
6. Irrigation headgates or diversions

In the office, all identified alterations and problem areas were measured directly from aerial photographs and recorded on the appropriate field inventory forms for analysis. Stream and bank alterations, eroding banks,

critical sediment sources, and irrigation diversions have been permanently recorded on aerial photographs for future reference. It is recognized, however, that some stream alterations inventoried were of a temporary nature, lasting no more than one irrigation season or until removed during the following high water period. Within this category are some instream gravel disturbances, usually for the purpose of directing water into irrigation diversions.

Streamflow in the Ruby River during the inventory period, obtained from gaging station data immediately below the reservoir, was 330 cfs.

FINDINGS

All stream and bank alterations recorded in the survey area are believed the result of man's activities and include actions by private individuals and groups, as well as county, state, and federal agencies and others over an extended period of time. It is not the intent of this inventory nor this report to point a finger at anyone relative to river alterations. A quantified measure of problem areas is essential to a systems approach to problem solving. This inventory was undertaken for that purpose.

Stream and Bank Alterations

Man's alterations of the Ruby River channel have been directed toward the realignment of the river's course, usually the straightening of channels by elimination of oxbows. For the most part, significant stream channel alterations are confined to the upper reaches of the survey area from Ruby

Dam to Laurin and within the first two river miles downstream from the Wheatly bridge. Beyond these areas relatively few manmade alterations were observed.

A total of 6,537 feet of stream channel alterations were identified in the inventory. This amounts to 2.6 percent of the river's course between Ruby Dam and the Beaverhead River (table 1).

Streambank protection measures, principally blanket rock riprap and rock jetties, have been installed on the Ruby River for a great many years for protecting and stabilizing eroding streambanks. These measures have been installed for the most part to reduce the economic loss of streambank erosion to both the private and public sectors. Over the years, many individuals, groups, units of government, state, and federal agencies have been involved with the installation of streambank protection measures on the Ruby River. These efforts represent programs of both an emergency and ongoing nature, carried out over an extended period of time. As a result of this inventory, a total of 23,893 linear feet of blanket riprap was identified along the banks of the Ruby River. This figure, based on the lengths of both left and right streambanks, represents the placement of rock riprap on 4.7 percent of the banks of the river through August 1974 (table 1).

TABLE 1

RUBY RIVER STREAM INVENTORY
August 19-22, 1974

Stream reach surveyed: Ruby Dam to Beaverhead River
Distance covered by survey: 48.55 miles or 256,338 feet
Streamflow conditions: 326 cfs at Ruby Dam

Channel and Streambank Alterations and Bank Erosion

	Total in Feet	Percent of Total Area Surveyed
Channel distance	256,338	
Streambank distance (left and right banks)	512,676	
Channel alterations	6,537	2.6
Blanket rock riprap	23,893	4.7
River gravel alterations	907	0.4
Brush removal	594	0.1
Eroding banks	30,936	6.0
Critical sediment source	5,433	1.1
	Number	
Irrigation diversions	26	

Instream gravel alterations other than stream channel modifications accounted for 907 linear feet or 0.4 percent of the river's channel course. Such alterations have been confined principally to removing river gravels to provide for greater flow capacities.

Eroding Banks and Critical Sediment Sources

Between Ruby Dam and the Beaverhead River, a total of 30,936 linear feet of eroding banks were recorded during the inventory--a figure representing six percent of the total stream course. Of this, 5,433 linear feet were judged as critical sediment sources or slightly more than one percent of the total bank area surveyed. Eroding banks rated as critical sediment sources were nearly always (1) devoid of vegetation, including sufficient woody or herbaceous root development to retard erosion; (2) vertical or nearly so; and (3) having soils consisting of finer-textured materials overlying loose sands and gravels.

In addition to critical sediment sources identified along the stream course, sediments passed through Ruby Reservoir are contributing silts and other fines to many gravel bottom areas, reducing their usefulness as trout spawning and food production areas.

Irrigation Headgates, Diversions, and Return Flows

Thirty-two irrigation headgates and diversions were identified during the course of the inventory. This figure is believed to be a minimum number since conditions along the river were often such that a number of diversions could have been missed.

CONCLUSIONS AND RECOMMENDATIONS

Where large-diameter rock (20"+) has been used in streambank protection activities, fish habitat losses have been lessened and, on occasion, even improved. This is especially true for critical sediment source bank erosion areas. On appropriate sites, the use of woody plant materials in conjunction with such structural measures as rock jetties and riprap can, in many instances, shorten the period during which the quality of fish habitat has been reduced or degraded by the placement of rock.

It is apparent that of the several species of riparian willows that occur along the Ruby River, the broad-leaved or those with leaves more or less obovate, as opposed to the lanceolate or narrow-leaved species, contribute much more to trout habitat. The broad-leaved willows produce many horizontal branches which overhang the stream, while the narrow-leaved species most generally grow upright, furnishing little stream cover. In future streambank protection projects, where native willow cuttings are to be used as part of streambank revegetation programs, care should be given to selecting only those species of willow that will provide the maximum stream cover benefits. The area between Laurin and Wheatly bridge contains significant reaches of high quality cover of value to trout.

About 90 percent of the eroding banks of the Ruby River occur in areas where pasturing, haying, and/or grazing come to or near the river's edge. Pasturing, haying, or grazing to the stream's edge aggravates bank erosion through reduction or elimination of effective root protection provided by

woody plant species. Streams need a protected fringe area of grasses, shrubs, and trees if they are to maintain reasonably stable banks with a minimum of erosion. Where adjoining areas are used for hay production or grazing, a space of at least two rods in width along the streambank needs to be reserved for riparian vegetation. If necessary, this should be fenced. Usually a fence for this purpose will be of little direct economic benefit to the landowner. If, under a stream management system, all conservation practices necessary to maintain a "stable" stream were installed, the individual landowner's cost would tend to be offset by the benefits accruing to him by the combined treatment of the entire stream. Since he would probably not receive immediate benefits from his costs, it would appear that some form of cost-sharing program as an incentive would be desirable.

Man-caused channel realignments occurring in the Ruby have had a degrading impact on trout habitat through elimination of instream and bank cover, disruption of spawning gravels and food-producing areas. Channel realignment activities, such as have occurred in the past, are unlikely to be undertaken in the future because of the passage of Senate Bill 310 as well as an awareness by local persons of problems frequently created by such activities.

Of major concern in the Ruby River system are the significant amounts of sediments that are being deposited over the channel bottom. In a number of instances, large reaches of gravel riffles are being filled with silts. This problem poses a threat to maintaining quality habitat for trout. Major sediment sources appear to originate above Ruby Dam, as well as from instream

cutbanks. Irrigation return flows were noted to contribute much sediments during observations made in August 1973; however, in the 1974 survey, this was not the case.

It appears that streambank erosion along the Ruby River could be reduced through modifications in the management of Ruby reservoir. Water is allowed to accumulate to or near reservoir capacity prior to the spring runoff period. This frequently results in sustained release of large volume flows during annual snowmelt periods, which aggravates stream problems such as bank erosion, channel changes, and sedimentation. Snow survey data to predict runoff could be incorporated into reservoir management procedures to provide for release of excess stored water at controlled rates prior to snowmelt. This should reduce the period of high volume flows during snowmelt.

In conclusion, this inventory was developed to provide a measure of stream problem areas, especially those associated with alterations, bank erosion, and critical sediment sources. It was undertaken to provide a means for achieving better stream management within the Ruby River valley. It was not intended to provide a complete physical or biological measure of a stream, stream hydrology, nor channel or bottom characteristics. A procedure developed by the U. S. Forest Service, titled "Stream Reach Inventory and Channel Stability Evaluation", has recently been issued to describe in detail these characteristics of a stream.

It is hoped that this inventory will encourage the undertaking of similar inventories in other stream systems of the state along with improved methods and procedures. It is recognized that river systems are dynamic and thus are always changing. It is essential, then, that this and similar inventories be periodically updated to record such changes.